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THE QUANTUM THEORY*

ONE of the most surprising and interesting developments of the quantum theory is that which shows that quantum numbers determine not only the size and form of the electronic Keplerian orbits in atoms, but also the orientation of these orbits in space with regard to a favored direction such as that provided by an intra-atomic or by an external magnetic or electric field of force. For any arbitrary value of the azimuthal quantum number k, the simple theory shows that there are exactly $k+1$ quantum positions of the orbital plane characterized by whole numbers. For example, if $k=1$ the normal to the orbit may be either parallel to the direction of the controlling field or at right angles to it. If $k=2$ the normal to the orbit may take up in addition to these two positions a third one, in which the normal to the orbit makes an angle of 60° with the field. For higher values of the quantum number k, the possible orientations of the corresponding orbits become regularly more numerous.

A striking confirmation of this theory is afforded by the very beautiful experiments of Gerlach and Stern.[1] In these a stream of atoms of vaporized silver was allowed to flow past a wedge-shaped pole of an electromagnet which provided a radial non-uniform magnetic field. The atoms were caught on a glass plate placed immediately behind the pole, and it was found that they were deposited in two distinct sharply defined layers, indicating that the atoms were sorted out into two distinct and separate beams. The positions of the bands on the plate showed that one of the beams was attracted by the pole and the other repelled by it, the attraction being slightly the greater in intensity. No evidence was obtained of an undeflected beam. From these results it was concluded that all the silver atoms in the stream of vapor possessed a definite magnetic moment, and that while the atoms were passing through the magnetic field their magnetic axes had two distinct orientations in space.

By assuming the correctness of this interpretation, Gerlach and Stern found from measurements on the

* Concluding part of the address of the president of the Section of Mathematics and Physics, British Association for the Advancement of Science, Liverpool, September, 1923.

[1] Gerlach and Stern, *Zeit. für Phys.*, vol. 7, p. 249, 1921; vol. 8, p. 110, 1921; vol. 9, p. 349 and p. 353, 1922.

various magnitudes involved in the phenomenon that within the limits of error of their experiments the magnetic moment of the normal atom of silver in the gaseous state was that of one Bohr magneton.

Bohr, also, has drawn attention to another possible illustration of the principle of the quantization of orbits in space. It is known that all the rare gases do not exhibit the property of paramagnetism. From this fact the conclusion has been drawn that the atoms of these gases in their normal condition do not possess any angular momentum. According to the quantum theory, however, this conclusion may not be warranted, for we have seen that for an atom which has a finite angular momentum and, consequently, possesses a magnetic moment, the theory prescribes certain definite directions for the axis of momentum relative to a magnetic field in which the atom may be situated. If we assume that the atoms of the rare gases in a magnetic field can place themselves with their momentum axes perpendicular to the magnetic field, it follows that they could appear to be diamagnetic, and all indication of paramagnetism on their part would be absent. In this connection I may point out that Bohr has made the suggestion that evidence in support of the validity of this view is derivable from the results of an analysis, on the basis of the quantum theory, of the anomalous Zeeman effect shown by the rare gases.

One point that may be worthy of notice in dealing with phenomena associated with the principle of space quantization is that the permitted orientations depend only on the values of the quantum number involved, and not on the magnitude of the magnetic field applied.

Orbits characterized by certain definite values of the quantum number should take up their permitted orientations in weak magnetic fields as well as in strong ones, provided the time allowed for the process to take place was ample, and provided suitable pressures were used and disturbances arising from the presence of contaminating gases were eliminated. Such conditions as these have recently been realized by Gerlach and Schutz,[2] and they have been able to obtain with sodium vapor at low pressures in the absence of foreign gases remarkably striking manifestations of the magnetic rotation of the plane of polarization of the light passing through the vapor with magnetic fields as low as a few tenths of a gauss.

This idea of space quantization may perhaps throw some light on the interesting and suggestive experiments of R. W. Wood and A. Ellett[3] on the polarization of the resonance light emitted by mercury and sodium vapors. In their experiments, it will be recalled, strong polarization of the resonance light from mercury or sodium vapors could be produced by weak magnetic fields properly orientated. Moreover, they found that the polarization of the resonance light emitted by these vapors in the presence of the earth's magnetic field could be destroyed by applying a magnetic field of less than one gauss provided it was suitably orientated. It is highly desirable that the experiments of Wood and Ellett should be followed up in order that sufficient information may be gained to enable us to elucidate the principles underlying the modifications in the polarization of the resonance light observed by them.

It seems clear that atoms of sodium, for example, when excited by the absorption of resonance radiation would tend during the period of excitation to take up definite and characteristic orientations even in weak magnetic fields that would result in the polarization of the resonance radiation emitted being different from that of the radiation emitted from atoms of the vapor situated in space in which absolutely no magnetic field existed. It should be remembered, too, that in the normal atom of sodium the orbit in which the valency electron is bound has the value 1 for its characteristic azimuthal quantum number k. When the atom is excited by the absorption of resonance radiation the azimuthal quantum number of the orbit, in which the valency electron becomes bound for a time, takes on the value 2. It seems clear then that the electronic orbit of the valency electron may be subject to different orientations relative to the rest of the atom when the atom is in the excited state from what it would be with the atom in its normal state. These relative orientations, moreover, would again be different in the presence of even a weak external magnetic field from what they would be in the complete absence of such a field. It is, therefore, quite conceivable that changes in orientation of electron orbits may be able to account for the phenomena observed by Wood and Ellett, but at present the whole matter appears to be rather involved and rather difficult to clear up with the information as yet available.

Among the most fruitful of the principles utilized by Bohr in the development of his theory of radiation is the Adiabatic Hypothesis enunciated by Ehrenfest.[4] To this hypothesis Bohr has given the name the Principle of Mechanical Transformability. Numerous examples of the application of this principle might be cited, but the one that concerns us most here is that which deals with the effect of the establishment of a magnetic field on the electronic orbits in atoms. It is well known that Larmor has shown that one result of the establishment of such a field is to endow an

[2] Gerlach and Schutz, *Die Naturwissenschaften*, vol. 11, Heft 28, p. 638, 1923.

[3] Wood and Ellett, *Proc. Roy. Soc.*, A, June, 1923, p. 396.

[4] Ehrenfest, *Die Naturwissenschaften*, vol. 11, Heft 27, July 6, 1923, p. 543.

electronic orbit with a uniform rotation about the direction of the magnetic field, the angular velocity being given by

$$\omega = \frac{1}{2}\frac{e}{m}\frac{H}{c}.$$

Langevin has also pointed out that the size and form of the electronic orbit remain unaffected by the magnetic field. Ehrenfest's hypothesis asserts that if the magnetic field be established slowly the energy of the electron in its orbital motion and the frequency of its revolution in the orbit may be changed, but the *number* of quanta defining its energy undergoes no modification. With the adoption of these principles it is an easy matter to show that when we quantize the angular momentum about the direction of the magnetic field the normal Zeeman components are exactly the same as those provided by the older classical theory of Lorentz. The singular beauty and simplicity of this method of explaining the normal Zeeman effect constitute one of the finest achievements placed to the credit of the quantum theory.

Efforts to explain the abnormal Zeeman effect have not as yet met with the same success. Among the contributions made to this subject perhaps that of Heisenberg[5] is the most stimulating and suggestive. In addition to offering an explanation of the abnormal Zeeman effect it constitutes an attempt to account for the doublet and triplet structure of series spectra.

Taking for example the case of an alkali element, Heisenberg postulates that through magnetic coupling a movement of rotation within an atom of these elements involves simultaneously the valency electron and the core of the atom as well. According to the theory it is supposed that in the various stationary states there is a partition of the angular momentum between the two, one half an azimuthal quantum being assigned to the core and $k - \frac{1}{2}$ azimuthal quanta to the electron. The author supposes further that through space quantization the two axes of rotation are in the same direction, and that the rotation of the core and that of the electron may take place either in the same sense or in opposite senses. As far as the radial quanta for the electronic orbits are concerned, it is assumed that they are given by $n' + \frac{1}{2}$ where n' has integral values. This device leads to the result that the total quantum number characterizing the orbit of the electron is an integer n that is equal to the sum $k + n'$. In this way the author is enabled, at the same time, to characterize the spectral terms in the Rydberg series formulae by integral quantum numbers.

This scheme, it will be noted, provides for the binding of the valency electron in one or other of two energy levels and reduces the frequency difference characterizing the members of the doublet series of the spectra of the alkali elements to a manifestation of what is practically a Zeeman effect produced by an internal atomic magnetic field. To account for the triplet structure of series spectra such as we obtain with the alkaline earth elements, Heisenberg supposes the magnetic coupling to involve not only the core of the atom but the two outer valency electrons as well. It is shown when the theory is extended to take account of an external magnetic field in addition to the internal one, that the Zeeman separations of the magnetic components of doublet and triplet lines are in exact agreement with the laws formulated by Preston and Runge.

When the external magnetic field is high compared with the internal one, the theory shows that for doublets and triplets the final result is a normal Zeeman triplet in complete accordance with the observations of Paschen and Back.[6]

To illustrate the validity of the theory Heisenberg used his formulae to evaluate the magnitude of the internal magnetic field of the atoms of lithium, and found that it led to a value of 0.32 cm^{-1} for the frequency difference characterizing the doublets of the second subordinate series in the spectrum of this element. As the experimental value found by Kent[7] is 0.34 cm^{-1}, it will be seen that the agreement is good.

Again, in connection with the matter of triplet series the theory shows that in the case of the p terms the ratio of the triplet frequency differences should be as 2:1, for the d terms it should be as 3:2, and for the f terms as 4:3. These deductions find ample verification in the measurements made on the frequency differences of triplet series in the spectra of such elements, as magnesium, calcium, strontium, barium, zinc and cadmium.

To say the least, the theory outlined above is extremely suggestive. It leads, however, to rather surprising results. If we are to account for doublet separations generally as being due to Zeeman separations produced by intra-atomic magnetic fields, it follows that with some atoms these must be exceedingly high. Taking the doublet separations of the second subordinate series in the spectra of the alkali elements, we find the following values for the internal magnetic fields of the different atoms:

Element	$\Delta\nu_p$	H_i
Lithium	0.34 cm^{-1}	7,173 Gauss
Sodium	17.18 "	366,744 "
Potassium	57.71 "	1,231,945 "
Rubidium	237.6 "	5,072,090 "
Caesium	554.0 "	11,826,330 "

[5] Heisenberg, *Zeit. für Phys.*, No. 8, p. 257 and p. 273, 1922.

[6] Paschen and Back, *Ann. der Phys.*, vol. 39, p. 897, 1912; vol. 40, p. 960, 1913.

[7] Kent, *Ast. Phys. Jl.*, vol. 40, p. 343, 1914.

If it should turn out that magnetic fields so high as those given above are present in atoms of elements such as those in the alkali group, the results obtained by Wood and Ellett would be easily explained.

Whether the existence of a magnetic coupling between the valency electron and the atomic core justifies Heisenberg in adopting the artifice of partitioning the quanta of rotation between the electron and the atomic core is a debatable point.

It does not appear to be permissible to adopt the value ½ for the azimuthal quantum number in defining the stationary orbits of a heavy atom such as that of uranium. In a recent paper by Rosseland,[8] in which a suggestion is put forward that the phenomenon of radioactivity exhibited by the heavier atoms may be due to some interaction between the nuclear and the external electrons in these atoms, he finds that the nearest approach of an electron to the nucleus in the atom of uranium according to Bohr's scheme of orbits is 16×10^{-12} cm. If the electronic orbit closest to the nucleus in the atom of uranium had ½ for the value of its azimuthal quantum number, it would mean that the shortest distance of approach to the nucleus would be equal to 4×10^{-12} cm. As the radius of the nucleus of the atom of uranium has been shown to be 6.5×10^{-12} cm. it is evident that such an orbit could not exist. For reasons of this character we are practically precluded from assigning to k, the azimuthal quantum number, a value less than 1 in defining the electronic orbits in atoms.

In this paper an attempt has been made to outline some of the leading features of the quantum theory as it is being used to solve the problems of atomic structure as well as of those connected with the origin of radiations emitted by atoms. Other illustrations of special interest might have been drawn from the treatment of problems that have arisen in a study of band spectra[9] and of fluorescence phenomena.[10] The recent work of Cabrera,[11] Epstein[12] and Dauvillier,[13] on paramagnetism, too, has a most interesting connection with the development of inner systems of electronic orbits in atoms in Bohr's scheme of the genesis of atoms.

I venture to think, however, that the few illustrations presented may serve, in a measure, to indicate the power and also the beauty of the methods being put forward to elucidate the problem of the origin of radiation.

J. C. MCLENNAN

UNIVERSITY OF TORONTO

[8] Rosseland, *Nature*, March 17, p. 357, 1923.

[9] Kratzer, *Die Naturwissenschaften*, vol. 11, Heft 27, p. 577, 1923.

[10] Franck and Pringsheim, *Die Naturwissenschaften*, Heft 27, vol. 11, July 6, p. 559, 1923.

[11] Cabrera, *Jl. de Phys.*, t. 6, p. 443, 1922.

[12] Epstein, SCIENCE, vol. lvii, No. 1479, p. 532, 1923.

[13] Dauvillier, *C.R.*, June 18, p. 1802, 1923.

BY-PRODUCT VALUES IN THE STUDY OF QUANTITATIVE ANALYSIS[1]

MANY of the friends of chemistry as well as some of chemistry's devotees, chemists in the making, do not completely appreciate the value of the study of quantitative analysis because they do not realize the tremendously important rôle which quantitative analysis plays in an industrious world and because some of the worth of its study is in the form of intangible values difficult to analyze and evaluate. Quantitative analysis may be regarded by the student as a meat and potatoes course. After his appetite has been whetted for it by preliminary general and qualitative courses, it forms the "pièce de résistance" of a college chemical education, but leaves room for such hearty side dishes as organic chemistry, physical chemistry, etc., and a light chemical research dessert. But it is meat and potatoes to a young graduate in a very literal sense, for the first position of a large majority of young chemists is in analytical work. Many an ambitious man has used his routine analytical position as a stepping stone to a larger salary in his industry.

The rôle of quantitative analysis in the world's work is truly tremendous. It is absolutely essential to the appraisal of basic raw materials—the different ores and minerals, coal, water, limestone and a host of others. It furnishes the means whereby factory processes are controlled in iron and steel, sulfuric acid, corn products, fertilizer, dye and explosives industries, for example. By it the finished products are analyzed. It is necessary to the enforcement of the federal pure food laws and the state fertilizer and feed laws and it is the backbone of pure and applied chemical research.

Once the student has had the importance of quantitative chemistry pointed out to him and the undoubted help that it will be to him in earning his living some day, he quickly understands part of the benefits of its study. There are, however, other values which the instructor and student both should keep in mind, if full benefit for the latter is to be derived from the analytical courses.

Chief among these are:

(1) Stimulation of the logical mental processes required in thinking through the reasons for the steps necessary in each new method, for figuring out results

[1] These undoubtedly also apply to many other laboratory courses as well.

and working problems—similar mental training to that afforded by mathematics.

(2) Training of the memory in the technic of the art. Much of the memory work involved is in learning to make the physical motions necessary adroitly and with fair speed. To achieve this result requires constant effort and much repetition.

(3) Practice in learning how to work. The student should learn not to waste time, to plan his work in advance, and make every minute count to the best advantage. If the courses are well planned he will have to learn this lesson or put in hours of extra work. To turn out work in quantitative analysis is largely a question of planning work in advance. Let the student remember that it is the man who looks ahead who will later have the chance to look behind.

(4) An increase in self-reliance and resourcefulness. When a precipitate appears where it is not expected, the student will not resign in despair but will logically review his steps and figure out in all probability what it must be and govern himself accordingly.

(5) Development of neatness and care in the manipulation of apparatus and in the recording of data and the calculation of results. In the very nature of things neatness and care are prime requisites in quantitative work. The exercise of the constant care and the neat cleanliness which are necessary to accurate analysis strengthens these attributes for use under similar conditions in other fields.

(6) Education in dependability and integrity. Nothing is so dangerous to the success of an analytical chemist as dishonesty in obtaining his results. There are few dishonest analysts in industrial work, for they can not hold their positions. Honesty not only is the best policy, but it is also the best sense, for ethical values are recognized by all educated men. Let the analyst remember that he is a scientist and that in common with all scientists his motto should be "veritatem quaerero," to seek the truth. It is what it is and not necessarily what he thinks it should be.

(7) Encouragement of the use of scientific methods in finding out realities, in discovering the truth. The methods of quantitative analysis are based on facts and it recognizes the value of conclusions founded on observation. It gives the thinking student a distrust of, even disgust for, conclusions reached by a line of reasoning which is based on assumptions.

(8) Admiration and respect for nature and natural laws. When the instructor rejects a student's erroneous results, thereby necessitating the repetition of an analysis, he explains that the results are wrong because of some error that the student himself introduced and not due to some supernatural agency, that the laws which govern the process are immutable. Admiration and respect for nature and natural laws are indeed among the chief by-products in the study of any pure science.

Quantitative analysis is one of the delectable handmaids of civilization. The student often realizes her worth from a dollars and cents point of view, but he often does not realize that, in wooing the lass for her money alone, he overlooks some of her charms. There are certain lessons she can teach that so enrich the student that in later years he will not have to depend on her money for his living. These are some of the by-product values of quantitative analysis.

WALTER S. FROST
UNIVERSITY OF NEW HAMPSHIRE

THE UNION OF AMERICAN BIOLOGICAL SOCIETIES

THE Union of American Biological Societies was formally organized by a meeting of the Council, composed of representatives of the various societies composing the Union, in Washington on April 26 last. The constituent societies were represented as follows:

American Association for the Advancement of Science:
At large, B. E. Livingston, Henry B. Ward.
Section F, Herbert Osborn.
Section G, C. O. Appleman.
Section N, C. A. Kofoid.
Section O, R. W. Thatcher.
American Association of Anatomists: Henry H. Donaldson, G. L. Streeter.
American Association of Economic Entomologists: A. L. Quaintance, William Moore.
American Dairy Science Association: C. W. Larson.
American Genetic Association: G. N. Collins, Sewall Wright.
American Physiological Society: C. W. Greene (A. J. Carlson also appointed, but not present).
American Phytopathological Society: Donald Reddick, C. L. Shear.
American Society of Agronomy: Firman E. Bear, R. W. Thatcher.
American Society for Horticultural Science: C. P. Close, J. H. Gourley.
American Society of Naturalists: H. S. Jennings, A. Franklin Shull.
American Society of Zoologists: W. C. Allee, F. R. Lillie.
Botanical Society of America: B. M. Duggar, J. R. Schramm.
Ecological Society of America: C. C. Adams, R. F. Griggs.
Entomological Society of America: A. N. Caudell, A. G. Böving.
Society of American Foresters: I. W. Bailey, W. N. Sparhawk.

The following were also present:

Representing the Temporary Executive Committee of the Union: I. F. Lewis, C. E. McClung.
By invitation: L. A. Rogers, R. J. Haskell.

The following By-Laws were adopted:

1. *Officers.* The officers of the Council shall be a president, secretary, and treasurer. The president and secretary shall be members of the Council. The treasurer shall be a member of one of the constituent societies of the Union.
2. *Tenure of office.* The president and secretary shall take office after the close of the annual meeting of the Council at which they are elected, and serve until the close of the next annual meeting, except that the officers elected at the first meeting of the Council shall serve at that meeting also. The treasurer shall be elected for three years.
3. *Executive committee.* The executive committee of the Council shall consist of the president and secretary and three other members to be chosen by ballot at the annual meeting of the Council.
4. *Vacancies.* Vacancies in the offices or in the executive committee shall be filled by the executive committee.
5. *Duties.* The duties of the officers shall be those usually pertaining to their respective offices. The duties of the executive committee shall be to carry forward all projects referred to it by the Council; to recommend new projects to the Council; to review projects proposed by members of the Union and make recommendations to the Council concerning them; to consider and recommend additional societies for membership in the Union; to nominate committees; to fill vacancies in the offices or committees; to determine times and places of meeting of the Council and of the executive committee; to prepare the annual report of the Council; and to perform such other functions as the Council may direct.
6. *Committees.* The executive committee shall appoint a committee on bibliography and publication and such other committees as the Council may direct.
7. *Relation to other organizations.* The Council shall take cognizance of the work of the National Research Council, the American Association for the Advancement of Science, and other similar organizations, with a view to cooperation and avoidance of unnecessary duplication of effort.
8. *New members.* Upon recommendation of the executive committee, the Council may admit additional societies to membership in the Union, and determine their representation in the Council.
9. *Finances.* The Council shall have power to receive and administer funds for the promotion of the purposes of the Union. Investments shall be made by the treasurer with the advice and consent of the executive committee. For the defraying of current expenses, the Council shall recommend assessments upon the member societies, to be distributed in such manner as the Council shall determine.
10. *Meetings.* The Council shall meet annually at such time and place as the executive committee shall determine and at other times on call of the executive committee.
11. *Amendments.* These by-laws may be amended at any regularly called meeting of the Council by a majority of those present and voting, provided notice of the proposal to amend, together with a copy of the proposed amendment, is mailed by the secretary to each member of the Council at least two weeks in advance of the meeting.

The report of the Committee on Bibliography and Publication, appointed on April 23, 1922, in conjunction with the National Research Council, was presented by the Chairman, J. R. Schramm. The recommendations of the Committee were adopted, and the Committee was instructed to prepare for publication a report of its work.

It was moved and carried that an American Commission on Zoological Nomenclature, to cooperate with the International Commission, be appointed in consultation with the societies most interested.

In connection with the annual meetings of the societies, the executive committee was instructed to appoint a coordinating committee to arrange the meetings of the various societies with as little conflict as possible.

Officers were elected as follows: President, C. E. McClung; Secretary, I. F. Lewis; Treasurer, A. L Quaintance; additional members of Executive Committee, E. W. Allen, C. W. Greene, and C. A. Kofoid.

I. F. LEWIS,
Secretary

SCIENTIFIC EVENTS

COOPERATION IN SCIENTIFIC WORK

A PLENARY session of the International Commission on Intellectual Cooperation, instituted by the assembly of the League of Nations, has been held at Geneva under the presidency of Professor Bergson. According to a report in the *Journal of the American Medical Association,* the commission approved the action of its subcommittee on bibliography recommending, in view of the impossibility of establishing at the present time a complete international library, the coordination of libraries already existing in the principal centers. The subcommittee recommended also the publication of a bibliographic index and conferences of experts on analytic bibliography to coordinate the work of reviewers and existing libraries, and thus prevent duplication of effort.

The commission decided to transmit to the Council and to the Assembly of the League of Nations a draft agreement for the protection of property rights in scientific work, as elaborated by Professor Ruffini, of Turin, formerly minister of public instruction in Italy. The request is made that the several governments establish protection for authors of scientific discoveries analogous to that accorded by law to the artist and the author. The establishment of an inter-

national agreement for the protection of scientific property rights would result in the creation of a new international league, which would rank with the two leagues now existing, the one for the protection of industrial rights and the other for the protection of artistic and literary property. Ruffini, in modeling his draft agreement, made use of the two French drafts, that of the French Confederation of Intellectual Workers (*The Journal*, May 19, 1923, p. 1467) and that submitted to the French parliament by M. Joseph Barthélémy, deputy from the department of Gers and professor in the law department of the University of Paris.

The Commission on Intellectual Cooperation adopted the following resolutions for promoting mutual aid in intellectual work:

1. The commission warmly approves the creation of national commissions on intellectual cooperation, such as have been established in the countries of central and eastern Europe.

2. The commission invites national commissions already created, and those that may be established later, to appoint delegates to meet with it to consider the best means of organizing mutual aid in intellectual work.

3. The commission begs the Council to request governments that are members of the League of Nations to lend moral and financial support to the endeavors of the national commissions.

4. The commission begs authority from the Council to accept donations from institutions that manifest an interest in its endeavors, such funds to be placed at the disposal of the national commissions.

Various reports on the present conditions of intellectual work in the several countries were presented to the commission. M. de Reynold, professor at the University of Bern, after investigating conditions in Switzerland, Germany, Holland, the Scandinavian countries and Luxemburg, and among Russian emigrants, has reached the conclusion that intellectual life is suffering even in countries that remained neutral during the war. This is due, on the one hand, to the economic crisis, and, on the other hand, to the indifference of governments and people, especially of the younger generation, to the needs of science and art. M. Castella, who was chosen to make a special inquiry in Switzerland, declared that in that country an undermining of cultural studies is taking place; students are becoming more and more utilitarian. M. Luchaire, who took charge of the inquiry among the Latin races of Europe, also testifies to a falling off of interest in intellectual work that promises no immediate practical return.

THE AUSTRALASIAN CONGRESS OF THE BRITISH MEDICAL ASSOCIATION

WE learn from *The British Medical Journal* that the Australasian Medical Congress—the first to be held under the direction of the federal committee of the British Medical Association in Australia—will open in Melbourne on November 12; it will meet under the presidency of Mr. G. A. Syme, and the parent association will be fitly represented by Sir William Macewen, F.R.S., the distinguished regius professor of surgery in the University of Glasgow, and president of the British Medical Association last year. He is expected to arrive in Sydney about October 17, by the mail boat from San Francisco, and will be the guest of Sir Walter Davidson, Governor of New South Wales. He will be entertained at dinner by the members of the Glasgow University Club on October 22, and by the New South Wales Branch on October 24. In Melbourne he will be the guest of the governor of Victoria, Lord Stradbroke, and afterwards of Lord Forster, the governor-general of the commonwealth. The arrangements for the congress are now far advanced, and everything is said to give promise of a most successful gathering. There will be twelve sections, the presidents being selected from the various states of Australia and from New Zealand. An exhibition of trade products, including medical and surgical instruments, books, drugs, foods and other articles of direct interest to the medical profession will be held in the new anatomy department of the University of Melbourne during the congress. This new department, the erection of which was begun in January, 1922, will be very complete. It will have two dissecting rooms, each capable of accommodating 300 students, a well equipped museum and a large theater. It will also provide a histological laboratory to accommodate 250 students, and special rooms for operative surgery, neurology and physical anthropology. It is hoped that Sir William Macewen will accept the invitation of the University Council to take part in the opening ceremony during the congress.

THE RESEARCH COUNCIL OF THE STATE COLLEGE OF WASHINGTON

AT the State College of Washington during the past year there was organized a research group known as the Research Council of the State College of Washington. Dr. Victor Burke was elected president and H. J. Dana, secretary.

The object of the organization is to stimulate research among the non-agricultural members of the faculty. The membership qualifications are similar to those of Sigma Xi, active membership being restricted to those members of the faculty (not connected with the College of Agriculture) who have made contributions to knowledge. Associate membership is open to those showing an active interest in research and who give promise of later achievement. It is the policy to favor the election of promising

students to associate membership. It is believed that election to membership and resultant association with active research workers will have a stimulating effect upon the students.

The activities of the local research council are patterned after those of the National Research Council and consist in holding open meetings at which the results of original investigations are presented and in holding business meetings to devise ways and means of stimulating research at the college. The results of the first year's activity are very encouraging.

The policy of the Sigma Xi has been to refuse the granting of chapters to state colleges. The need of an organization serving the same purposes as the Sigma Xi is keenly felt by Sigma Xi members serving on state college faculties. The Research Council of the State College of Washington serves the same function as a chapter of the Sigma Xi. The membership requirements are the same and the activities broader and believed to be more effective in stimulating research.

It is believed that the organization of similar groups at other state colleges should be encouraged. A copy of the Constitution of the local group can be obtained by writing to the undersigned.

VICTOR BURKE

COLLEGE STATION,
PULLMAN, WASHINGTON

THE SOCIAL AND ECONOMIC SCIENCES AT CINCINNATI

THE program of Section K, American Association for the Advancement of Science, for the Cincinnati Meeting, from December 27 to January 2, will chiefly concern itself with matters illustrating social and economic progress since the war. The following is a tentative announcement of the program, which will probably be somewhat enlarged before adopted in final form:

Morning Session, December 27

A plea for business strategy in national and international policy: DR. JOHN FRANKLIN CROWELL.

Development of transportation by air: PROFESSOR EDWARD P. MAURER.

Potash resources in the Panhandle of Texas: CHARLES M. DABNEY.

Afternoon Session, December 27

A declaration of principles in labor relations: RICHARD F. GRANT, president of the Cleveland Chamber of Commerce.

Labor relations in printing industry: FRANCIS H. BIRD.

Progress in business integrity: RUDOLPH M. BINDER.

Progress in the development of man power since the war: HUGO DIEMER.

Morning Session, December 28

Group insurance: WM. J. GRAHAM.

Share of insurance in the prosperity of the country since the war: JAMES E. ELSTON.

Progress in life insurance: GENEVIEVE M. CARR.

Progress and science of community fellowship: CHARLES H. PENNOYER.

Afternoon Session, December 28

Railways under the transportation act: H. T. NEWCOMB.

Economic aspects of the forestry situation in Canada: DR. C. D. HOWE.

The development of the nation's hidden vital resources: PROFESSOR HENRY P. SHEARMAN.

Economic problems in the home: LOUISE STANLEY.

Morning Session, December 29

Progress in methods of inquiry and research in the social and economic sciences: PROFESSOR F. STUART CHAPIN.

The economic value of scenic national parks and historical sites: DR. GEO. F. KUNZ.

World commerce as a scientific discipline: DR. JOHN FRANKLIN CROWELL.

The increased use of metric weights and measures: HOWARD RICHARDS.

Will profit sharing bring management sharing? DR. JOSEPH MAYER.

Germany's economic reconstruction: DR. FREDERICK L. HOFFMAN.

F. L. HOFFMAN,
Secretary

AMERICAN ORNITHOLOGISTS' UNION

THE forty-first stated meeting of the American Ornithologists' Union will convene in Cambridge, Mass., from October 9 to 11.

The public meetings will be held in the lecture hall of the Museum of Comparative Zoology, from 9.30 A. M. until 4.30 P. M. each day.

On Tuesday evening, October 9, at 8 o'clock, the members and their guests are cordially invited to meet at the Boston Society of Natural History, 234 Berkeley St., corner Boylston St., Boston, for a social evening with an illustrated lecture of general interest.

On Wednesday evening, October 10, the annual dinner will be held.

On Friday, October 12, there will be the following field trips: (1) To Cohasset, south of Boston, where there will be opportunity to visit several bird-banding stations and to observe the offshore migration of Scoters; (2) To Plum Island, north of Boston, an area of salt-marsh, sand-dunes and beach especially favorable for migrating birds of many kinds at this time of year.

The headquarters of the union will be at the Cop-

ley Square Hotel, Huntington Avenue and Exeter St., Boston.

Members expecting to be present are requested to notify the chairman of the committee, George C. Deane, 80 Sparks St., Cambridge, in advance of the meeting in order to facilitate final arrangements.

SCIENTIFIC NOTES AND NEWS

MAJOR GENERAL SIR DAVID BRUCE, distinguished for his work on tropical diseases, has been elected president of the British Association for the Advancement of Science for the Toronto meeting.

THE honorary degree of doctor of science was conferred by the University of Liverpool during the recent meeting of the British Association on Sir Ernest Rutherford, president; Dr. Ernest Howard Griffiths, general treasurer; Professor Niels Bohr, professor of physics, University of Copenhagen; Professor G. N. Lewis, professor of chemistry, University of California; Professor G. Elliot Smith, professor of anatomy, University of London; Dr. Johs. Schmidt, director, Carlsberg Laboratory, Copenhagen, and Professor J. C. McLennan, professor of physics, University of Toronto.

IN honor of the completion of forty years of service by Dr. Edgar Henry Summerfield Bailey as professor of chemistry at the University of Kansas, a celebration on September 21 was arranged by the university, the Kansas Academy of Science and the Kansas Section of the American Chemical Society. In addition to a dinner in the evening there were in the afternoon addresses by two of Dr. Bailey's former students—Dr. E. C. Franklin, of Stanford University, president of the American Chemical Society, and Professor E. V. McCollum, of the Johns Hopkins University.

DR. HERMANN THOMS, director of the Pharmaceutical Institute of the University of Berlin, has passed through the United States on his way to Japan where he will give lectures as the guest of his former Japanese students. Dr. Thoms has been elected an honorary member to the American Pharmaceutical Association.

DR. BOHUSLAV BRAUNER, professor of chemistry in the Bohemian University, Prague, has been elected an honorary foreign member of the French Chemical Society.

PROFESSOR RICCARDO VERSARI, director of the institute of anatomy of the University of Rome, has received the gold medal of the Italian Society of Sciences for a recent work on embryology of the human eye.

H. S. JONES, formerly chief assistant in the Royal Observatory, Greenwich, has been appointed H. M. astronomer at the Cape Observatory to succeed the late Mr. Hough.

DR. G. F. FREEMAN, chief of the division of plant breeding of the Texas Agricultural Experiment Station, has accepted an appointment as director of the recently created Technical Service in the Haitian Department of Agriculture, beginning his work on September 1.

DR. E. G. NOURSE, head of the department of agricultural economics at the Iowa State College, has accepted a position as dean of the Institute of Economics at Washington, D. C. C. L. Benner, assistant professor of agricultural economics, has also accepted an appointment with the same institution.

CARL GEISTER, of the chemistry section of the Iowa Engineering Experiment Station, has been appointed to a fellowship at the Mellon Institute. The fellowship is one which the Vitrified Tile Floor Association has established at Mellon.

J. C. EVANS, chemical engineer, formerly with the National Bureau of Standards, is now in charge of the cement used in the Wilson Dam at Muscle Shoals, Ala.

GEORGE A. STETSON has resigned his position as assistant professor of mechanical engineering at Yale University and is now engaged in the coal business in Boston.

CALVERT TOWNLEY has been appointed representative of the Federated American Engineering Society and the American Institute of Electrical Engineers on the American committee of the world power conference to be held in London in 1924 in connection with the British Empire Exposition.

DEAN HENRY S. GRAVES, of the School of Forestry of Yale University, has been appointed a permanent member of the New Haven Department of Public Parks.

PRESIDENT A. F. WOODS, of the University of Maryland, acted as official representative of the American Association for the Advancement of Science at the World's Dairy Congress, held in Washington, D. C., on October 2 and 3.

DR. STEPHEN A. DOUGLASS, head of the tuberculosis branch of the National Military Home Hospital, Dayton, Ohio, has been offered the clinical directorship of the Millbank Memorial Fund, which was established to conduct clinics in various localities in an effort to lower the death rate in the United States. Clinic centers will be established in Cattaraugus County, N. Y., in Syracuse, N. Y., and the Bronx, New York. Between $300,000 and $400,000 will be

spent annually for at least five years, under the administration of a board of trustees.

A COMMITTEE of eleven members has been appointed by the American Institute of Chemical Engineers to investigate the problems of corrosion. It is composed of four producers: W. H. Bassett, American Brass Co.; J. P. Hubbell, New Jersey Zinc Co.; P. D. Merica, International Nickel Co.; D. W. Thompson, National Lead Co., and of seven non-producers: W. S. Calcott, E. I. du Pont de Nemours & Co.; W. M. Corse, National Research Council; J. V. N. Dorr, Dorr Co.; R. T. Haslam, M.I.T.; E. C. Lathrop, S. S. Sadtler Co.; A. E. Marshall, consulting chemist, and W. D. Richardson, Swift Co.

DR. H. FOSTER BAIN, director of the United States Bureau of Mines, has resumed his work in Washington after an absence of more than two months, during which he assisted the Department of Commerce in its inquiry into nitrate export conditions in Chile.

O. F. COOK, of the Bureau of Plant Industry, and a party of botanists, including William R. Maxon, of the National Museum, recently returned from Central America and the West Indies, where they have been investigating the sources of crude rubber with the purpose of increasing its production in tropical America. Several weeks were spent in Panama, Costa Rica, Nicaragua and Haiti.

PROFESSOR CARL VOEGTLIN, of the Hygienic Laboratory, U. S. Public Health Service, has returned from Europe where he attended a conference on biological standardization of the Health Committee of the League of Nations. He also attended the International Congress of Physiology and visited various scientific institutions.

D. R. HOAGLAND, associate professor of plant nutrition, of the University of California, and W. Metcalf, associate professor of forestry, have been given a year's sabbatical leave of absence for foreign travel and study.

DR. G. DAVIS BUCKNER, research chemist at the Kentucky Agricultural Experiment Station, has returned after a year's study at the Pasteur Institute, Paris, and the Oceanographic Institute at Monaco.

GENERAL LORD LOVAT, chairman of the forest commission of Great Britain, C. E. Legat, chief conservator of forests in South Africa, and Professor R. S. Troup, head of the forestry department of the University of Oxford, who have been attending the British Empire Forestry Conference held in Ottawa from July 25 to September 7, recently visited the U. S. Forest Products Laboratory at Madison, Wisconsin.

THE Canadian Medical Association is arranging for a Lister Oration to be given once every three years. The first of these will be given next year at the annual meeting in Ottawa by Dr. John Stewart, of Halifax. Dr. Stewart was one of Lister's house-surgeons in the early days in Edinburgh.

PROFESSOR GIOVANNI LOPPA, director of the Astronomical Observatory at Collerania, Abruzzi, committed suicide on September 15. He had been suffering from nervous prostration.

DR. NILS BOHR, of the University of Copenhagen, winner of the Nobel Prize in physics for 1922, will lecture at the Carnegie Technology some time in the latter part of November. Other speakers include Dexter S. Kimball, dean of the College of Engineering at Cornell University, for October 23, 24 and 25; Professor Alfred Stansfield, of the department of metallurgical engineering at McGill University, Montreal, Canada, who will lecture during the period between January 14 and 19.

THE following public lectures are being given this fall at the Brooklyn Botanic Garden:

October 5. The life of the plant. ARTHUR HARMOUNT GRAVES, curator of public instruction, Brooklyn Botanic Garden.

October 19. Bulbs and their allies. HUGH FINDLAY, assistant professor of agriculture, Columbia University.

October 26. The evolution of flowers. ALFRED GUNDERSEN, associate curator of plants, Brooklyn Botanic Garden.

November 2. Ten years of garden work with Brooklyn boys and girls. ELLEN EDDY SHAW, curator of elementary instruction, Brooklyn Botanic Garden.

THE sum of $1,500 has been placed at the disposal of the College of Agriculture of the University of Wisconsin by the Sewerage Commission of the City of Milwaukee for the establishment of a fellowship to study the best methods of using activated sludge as a fertilizer. This material is prepared in large quantities as a by-product in the disposal of Milwaukee sewerage. O. J. Noer has been appointed to the fellowship, which will be under the jurisdiction of the soils department.

THE National Research Council has a fellowship fund provided by The American Seed Trade Association. The total fund available is $2,000 per year. Of this $1,500 to $1,700 will be for the fellow's salary and the rest for traveling and other expenses. The problem to be investigated is the field value of hard seeds of clovers and alfalfas. The fellowship will be located at a large agricultural institution in a region where the problem is important economically. Applications for this fellowship and references may be sent to William Crocker, The Thompson Institute for Plant Research, Yonkers, N. Y.

AN arrangement has been made by which the American Institute of Chemical Engineers and the Institution of Chemical Engineers in the United Kingdom are to cooperate in the exchange of all transactions at cost. As a mark of mutual courtesy the roster of the combined societies is to be printed under a single cover.

A DINNER in celebration of the completion of the hundredth year of the *Lancet* will be held in London on November 28. Sir Donald MacAlister, president of the General Medical Council, will take the chair, supported by the president of the Royal Society, the president of the Royal College of Physicians of London, the president of the Royal College of Surgeons of England, the chief medical officer of the Ministry of Health, the president of the Royal Society of Medicine, and the president of the Medical Society of London. Dr. J. W. H. Laing and Mr. H. D. Gillies are acting as honorary secretaries to the dinner committee.

DR. JAMES MOORES BALL, of St. Louis, has presented his collection of ophthalmic specimens to the Army Medical Museum, Washington. The museum was rich in specimens illustrative of other branches of surgery, but was poor in eye specimens. The collection includes a large number of original drawings of external ocular diseases, photographs, pathological preparations of eye diseases, microscopical sections, eye instruments, rare ophthalmic literature, copies of well known ophthalmic atlases, and many portraits of bygone leaders in ophthalmic work. The drawings and pathological specimens have already been installed in the museum.

THE *Journal* of Industrial and Engineering Chemistry writes: "One of the most important recent developments at Carnegie Institute of Technology has been the organization of an advisory board of Pittsburgh business and scientific men to cooperate with the work of the department of mining and metallurgy. C. W. Heppenstall, president of the Heppenstall Forge and Knife Company, has been elected chairman of this board. The immediate function of the advisory board will be to cooperate with the institute in the solution of current problems affecting the work of the Mining and Metallurgy Department. Beginning with the next college year, the Institute of Technology announces that special courses for graduates of liberal arts and technical colleges will be given by the Department of Mining and Metallurgy. The purpose of these courses will be to train young men for jobs in the metallurgical and allied industries leading to positions of managerial, sales and executive capacities. A consistent demand is being made in this and other iron and steel producing districts, for college men, particularly in the non-technical capacities, from the lack of whom this industry has long suffered. The cooperation of the newly organized advisory board has already been provided in preparing the curricula for these courses."

ACCORDING to *The Observatory*, "News has also been received from Australia that the suggested Solar Physics Observatory has been approved, and the appointment of a director is under consideration. This project has been before the world for many years; it dates from before the war, and on the occasion of the visit of the British Association to Australia in 1914 a deputation on the subject received considerable encouragement from the Government. But of course the war put a stop to everything of this kind for a time at any rate. The news recently received is doubly welcome—firstly on the obvious ground that a new observatory will be gained in a very important longitude, and secondly because we may hope that the sanction of the project is an indication that our Australian friends have made good progress in recovering from the disastrous effects of the war. Special congratulations are due to Dr. Duffield for his success in obtaining this government support, which is largely a result of his personal visits to Australia."

THE British Association Table at the Naples Station was occupied by Dr. Cresswell Shearer, F.R.S., from April 10 to June 21, 1923, and he has sent in a report to the committee as follows: "I was engaged on the problem of the respiration of the growing parts of embryos. The main result of my work was a confirmation (by direct manometer measurements) of Child's work on the determination of oxidation-gradients of the embryo, by the susceptibility methods, using cyanide and other chemical agents. I was able to carry the problem a step farther than Child, in that I was able to find the acetone powders of parts of the embryo still retained (in a reduced form) the different (respiratory) relationships they showed in the living embryo, in that an acetone powder of the embryo head had four to six times the oxidation-rate of a similar quantity of powder prepared from the trunk and tail region of the same embryo."

THE first meeting of the National Council of Mental Hygiene of Great Britain, since it became a legally constituted body, was held in London, July 12, with Sir Courtauld Thomson in the chair. Mr. Clifford Beers, founder of the National Committee for Mental Hygiene in the United States, gave an account of the work in America. An international congress of mental hygienists will be held in the United States in 1925.

THE Polish Physical Society was founded in April, 1920, with five branch sections in Warsaw, Cracow,

Lwów, Wilno and Poznan respectively. Professor Ladislas Natanson, of the Jagellonian University of Cracow, was the first president of the society for the period 1920–23, and in the general assembly held in Warsaw in April last, Professor St. Pienkowski was elected president and Professor Natanson vice-president.

A NEW observatory is being built on the new west campus of the University of Iowa. It will contain a five-inch equatorial instrument, the dome for which is being built in the university's engineering shops. One of the best transit instruments is being secured for the transit room.

UNIVERSITY AND EDUCATIONAL NOTES

CORNELL UNIVERSITY reopens with two new buildings ready for occupancy. The Baker Laboratory of Chemistry and the new dairy building of the State College of Agriculture are completed. The laboratory, built and equipped at a cost of about $2,000,000, will not be formally dedicated this fall. The American Chemical Society has arranged to hold its annual fall meeting in Ithaca in October, 1924, and at that time the dedication will take place. The dedication of the dairy building, erected at a cost of $300,000, will be on October 21. The World's Dairy Congress, meeting in Syracuse that week, will move to Ithaca on Saturday and hold its final session there. Governor Alfred E. Smith, of New York, will be one of the principal speakers.

DR. H. J. WEBBER, professor of subtropical horticulture and director of the Citrus Experiment Station, has been appointed acting dean of the College of Agriculture of the University of California.

RICHARD MONTGOMERY FIELD, of Brown University, has been appointed assistant professor of geology at Princeton.

DR. NORMAN MACDOWELL GRIER, of Washington and Jefferson College, has been appointed assistant professor of evolution at Dartmouth College.

DR. F. R. GRIFFITH, Jr., instructor in physiology at Harvard University, has been appointed assistant professor of physiology at the University of Buffalo. Mr. J. J. MacDonald, formerly assistant in biology at the Massachusetts Institute of Technology, has been appointed instructor in physiology at the same institution.

WILBUR HOFF, of the Iowa State College, has become head of the chemistry department at Upper Iowa University at Fayette, Iowa.

DR. PAUL KIRKPATRICK, formerly Whiting fellow in physics at the University of California, has taken up a professorship in the department of physics of the University of Hawaii, at Honolulu, T. H. Dr. Kirkpatrick fills the place left vacant by the removal of Dr. Arnold Romberg to the University of Texas.

DISCUSSION AND CORRESPONDENCE

RELIEF FOR RUSSIAN SCIENTISTS: FINAL REPORT

THE two measures of relief for Russian scientists undertaken at my suggestion by American scientific men were finished during the summer, and a brief statement of what has been done in connection with each is due those who responded so promptly and generously to the call for help.

The first measure was that of the collection of a small sum of money to be distributed to Russian university professors and other intellectuals in Berlin exiled from Russia by the Soviet Government. In response to my call for small subscriptions to make up $1,000, the sum of $1,273 was quickly collected and was sent through the American Relief Administration to one of its most capable men in Europe, Mr. Gardner Richardson, who, in connection with a representative in Berlin of the American Y. M. C. A., organized a committee among the Russian exiles by which the investigations into the comparative need of the different members of the exiled group, and the allotment of particular sums, were made under the general supervision of Mr. Richardson and his American colleague.

I have now received a detailed account of the giving out of all of the money, and have been asked by the Russian committee to express to the American contributors to the fund the heartfelt gratitude of the beneficiaries. Among those aided were fourteen professors from various Russian universities and twenty-one other intellectuals. Although the sums allotted to each were necessarily small they have meant, I am assured, the actual saving of some lives as well as the amelioration of the sad lot of others.

The other measure of relief for Russians was on a much larger scale than the one just referred to and very different in kind. It was the measure organized and carried out with the assistance of the National Research Council and the American Relief Administration, by an unofficial committee composed of L. O. Howard, David White, Raphael Zon and myself. This committee, being aware of the fact that all through the war and for a considerable period after it Russian scientific men and organizations were unable to receive foreign scientific publications, undertook to collect American scientific books, journals and papers published since January 1, 1915, by appealing for gifts of such material from publishing houses,

university presses, scientific organizations and individuals, for distribution among Russian universities, technical schools and scientific organizations. The American Relief Administration undertook, at its own expense, to receive in New York, warehouse, repack and transport to Russia and finally to distribute there in detail, under the recommendations of a special committee of responsible Russian scientists representing the major universities and societies, all material collected.

This undertaking, resulting in the collection in America and distribution in Russia of over 25,000 pounds of recent American scientific literature, most of it of excellent quality, has now been entirely completed, and a full statement rendered by the American Relief Administration to the American committee of the exact distribution of every piece of scientific literature. A host of grateful acknowledgments from the beneficiaries to the donors of the material, as well as to the American committee and the American Relief Administration, have been received and are a pleasing testimonial to American sympathy and generosity. Many of these acknowledgments express two hopes: first, that more American scientific literature can be received, and, second, that the Russian organizations may soon be in position to send their own publications in exchange for those received. However, as the American Relief Administration has now completed its work in Russia and has withdrawn all of its personnel, and as the mails are now open to private sendings to and from Russia, and the Smithsonian Institution's Bureau of International Exchange is now functioning again as regards Russia, the committee will not undertake further service.

The American Committee, in closing its labors, wishes to express its own warm thanks, in addition to those it has been asked to express on behalf of the Russian beneficiaries, to those many scientific organizations and men who generously participated in this unusual relief undertaking. I wish also to add my personal thanks to SCIENCE for the use of its columns in making the appeals necessary for these attempts to aid Russian scientific men in their period of distress.

VERNON KELLOGG
NATIONAL RESEARCH COUNCIL

ENTOMOLOGICAL ILLUSTRATIONS

IN the course of a review in a recent number of SCIENCE Dr. A. D. MacGillivray[1] takes the opportunity to comment adversely upon a certain type of illustration that is now being used to some extent by entomologists. I am not especially concerned with his remarks as they apply to the particular paper reviewed, but as they are intended to apply to entomological illustrating in general I happen to be somewhat interested.

Says Dr. MacGillivray,

> Figures where one half shows the dorsal surface and the other half the ventral surface are being produced by many authors. This is to be deplored because such figures never give the perspective of the insect as a whole that can be secured from complete figures of each surface, while there is always confusion and doubt as to the accuracy of the structures located on and near the meson, and [he adds with an insouciance worthy of a congressman] so long as the government is financing the project, the question of expense should not be a serious one.

Now I have perhaps used this type of illustration as much as any one, for I count something over 300 published figures of this sort for which I am responsible. Furthermore, I have induced my students to use it also, and I am inclined to believe that it will eventually be recognized as a standard method in entomological work. Consequently, I feel impelled to rise to its defense.

If any other excuse for this reply be considered necessary it may be found in my belief that the matter of the proper type of illustrations to accompany our systematic work in entomology, at least, merits the most serious consideration. I am committed to the belief that the willingness and the ability to produce figures, or the possession of such financial support as is necessary to have them produced, is a part of the necessary equipment of any systematist who wishes his work to endure. The character of these figures is a most important matter.

Dr. MacGillivray's use of the word "perspective" is somewhat peculiar, for of perspective as it is understood by artists these figures in question contain none whatever. I take it that he means the general shape and appearance of the insect and this being the case I am unable to see that his objection has any force. As a matter of fact it is just as easy to gain a sufficiently clear conception of the general form from these drawings as from any other after one has become accustomed to them. Such a drawing, like a topographical map, requires a certain amount of interpretation but is none the less usable.

The objection that confusion may arise as to the exact character of structures on the meson has some slight foundation, but Dr. MacGillivray's sweeping statement that there is "always" doubt concerning them is a trifle too all-inclusive. My experience with these figures has extended through such diverse groups as the Anoplura, Mallophaga, Coccidae, Aphidae, Psyllidae, Hippoboscidae, Streblidae and Nycteribiidae, and I have yet to find a case where the obscuring of structures on the median line is of any very great importance. In a few cases where there is

[1] MacGillivray, A. D., "The Maskell collection of coccidae," SCIENCE, LVII, 734, 1923.

a longitudinal median sulcus which coincides with the line separating the two halves of the drawing there may be some trouble. In other cases of median structures, such as setae, there are very obvious ways of avoiding the difficulty.

I am aware that in addition to these objections there is the further one that these drawings are the source of acute mental pain to some because of their "inartistic" appearance. This is a purely subjective difficulty that arises from a very common misconception of the purpose of a scientific illustration. A scientific illustration is not intended merely as a pretty picture and it has nothing to do with art. Its purpose is merely to present in the simplest and most accurate manner the things that it is desired to show and its production involves nothing more than good draftsmanship. If in addition to these qualifications it is also artistic—whatever that may mean—so much the better. But I can point to many entomological illustrations that have completely lost their scientific value in the often labored strivings of their makers to be artistic.

The advantages of these divided drawings are several. In the first place there is the very great saving in the cost of the blocks. Obviously, the presentation of full drawings of each side of an insect would cost just twice what these divided figures cost. I am inclined to believe that no one will disagree with me when I remark that this is not an unimportant factor. In the second place, there is the saving in the time of making the drawings, a saving that amounts to at least one third. I doubt if any one who has not himself undertaken the production of the figures to accompany an extended paper appreciates what this means. There is also the saving of space in printing. There is the convenience of having the two sides of an object so figured that they may readily be compared. Such advantages seem greatly to outweigh any objections that I have thus far seen urged against these figures.

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FOREST DISTRIBUTION IN THE NORTHERN ROCKY MOUNTAINS

J. E. KIRKWOOD, professor of botany in the State University of Montana, has written a book on the "Forest Distribution in the Northern Rocky Mountains," which has appeared as Bulletin No. 247, State University Studies Series No. 2, Missoula, Montana, 1922. It is illustrated with 45 figures, some of which are photographs of forest scenery, some of them are graphs of precipitation, temperature and general humidity, while some are maps and profiles of topography. After an introduction in which the principal collections and the botanical collectors are mentioned, the author describes the topography of Montana and its climate (with tables and diagrams).

In tracing the sources of the vegetation, Professor Kirkwood refers to the rich flora of the Tertiary Period in giving the past history of the plant life of the region with lists of the principal genera. The migrations of the present day species into the northern Rocky Mountains is considered with some fulness. The author describes the northern element which appears to have moved southward along the Rocky Mountains into Montana. The eastern contingent includes a number of trees and shrubs. The western element be believes is the most conspicuous in the forest flora of the mountainous region, and he gives a list of species which have entered from the west, or northwest. Other details of possible migration are included.

Chapter IV deals with the General Forest Aspects where coniferous vegetation is dominant with yellow pine and Douglas spruce as the prevailing trees over the greater part of the region. East of the divide, the forest is more open, and assumes a more xerophytic aspect. In a number of tables the composition of the forests of its different forest sections is given with the range in altitude of each species. Percentage compositions are included. The forest zones and formations are then presented in some detail. Professor Kirkwood describes the foot hill vegetation, the slide rock succession, the forest of the western valleys, and the forests of the montane, or Canadian belt, where *Pinus contorta, P. albicalis, Picea Engelmanni* and *Abies lasiocarpa* are the principal species. The subalpine zone of the Montana Rockies (the Hudsonian Zone of Merriam) has a few trees, a limited number of shrubs and herbaceous perennials. The forests are broken into limited tracts by meadows, bogs, lakes, rock fields, snow fields, chasms, etc. A summary and bibliography complete this contribution of 180 pages to forest botany.

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QUOTATIONS

SCIENCE AND PUBLICITY

THOUGH the British Association welcomes membership from the general public, it is not too much to say that the presidential addresses, and most of the papers presented to Sections, are intended for audiences of special scientific workers. In the case of a body like the British Medical Association, membership is limited to professionally qualified men, and in the Sections, therefore, no attempt need be made to deal with scientific subjects in popular terms. With its

mixed membership, however, the British Association is in a different—and also more difficult—position. Interpreters are needed, if not in the Section rooms themselves, then in the public press. Leading newspapers prefer that their own correspondents or contributors should perform this function, but there are many others which would gladly make use of notes and articles on scientific subjects suitable for the general reading public.

In the United States an institution entitled "Science Service" was established a year or so ago to provide such popular articles as a scientific news syndicate, and it now supplies about fifty American newspapers, and several in Canada and other parts of the world, with news Bulletins sent from Washington every day except Sunday. "The first consideration in a Bulletin story," says a circular of instruction to writers of articles, "is to tell of or interpret a scientific event. But the news stories must be so well written that large national newspapers will use them without rewriting or revision, either in form or language. Write your story so that those who know nothing about science will understand and want to read it. Weave in the scientific background that the man in the street does not have. Use simple words. Make your story as graphic as if you were talking about it." It is pointed out, in addition, that "'By Science Service' must stand for accuracy of content and implication."

In order to establish this publicity agency for science, a generous benefactor gave a large sum to a Board of Trustees which includes among its members several of the most distinguished men of science in the United States. The whole field of scientific activity everywhere is covered by "Science Service," and the Bulletins are first-rate examples of what can be done to present scientific progress in popular and yet accurate form. We understand that the demand for the Bulletins from newspapers is now sufficient to make this admirable news agency practically self-supporting.

Here, then, we have an excellent example of what can be done successfully for the popularization of science; and it is obvious that the constitution and methods of such an organization are very different from those of the British Association, though the aims of both are "to promote general interest in science and its applications." We believe that the National Union of Scientific Workers contemplates establishing a similar scientific news agency to that of "Science Service," and a beginning has already been made by the British Science Guild by the issue of Publicity Pamphlets sent to the newspaper press for reproduction in whole or in part without payment. Since January, 1921, the Engineering Foundation of New York has been issuing a series of such "Research Narratives," each containing the story of some research, discovery or notable achievement in science or engineering. In one form or another these narratives have found their way through practically the entire range of the public press in America as well as the technical journals.

It is clear, therefore, that we in the British Isles are much behind the United States in the provision made for publicity for science. Our scientific societies are second to none, and the number and value of papers published by them are higher now than ever they were, yet no adequate agency exists to extend the knowledge of this work beyond scientific circles and thus to create in the public mind a feeling of pride in our scientific achievements. A great opportunity awaits the benefactor who will provide a liberal sum to establish a British science publicity service comparable with what has proved so effective in America. Political, social, religious, temperance, labor and scores of other organizations regard it as a duty to carry on their propaganda by means of leaflets and like publications, but science is content to keep its message to itself. It is no wonder, therefore, that the community understands so little of the value and meaning of science. Let us hope that means will soon be forthcoming to establish a bureau which will not only make the proceedings of annual meetings of the British Association widely known and easily intelligible, but will also, throughout the year, continue to interpret scientific advances to a world eager to learn of them but unacquainted with the technical vocabularies in which they are commonly expressed.—*Nature.*

SCIENTIFIC BOOKS

World Weather, Including a Discussion of the Influence of Variations of Solar Radiation on the Weather and of the Meteorology of the Sun. By HENRY HELM CLAYTON. 8vo. New York, The Macmillan Co., 1923. Pp. XX, 393; Figs. 265; Pls. XV.

"WORLD WEATHER" embodies the results of the author's investigations, study and thought during his association of more than twenty years with the Blue Hill Observatory, and, more recently, during his term of service as chief of the forecast division of the Argentine Meteorological Office. Those who have followed Mr. Clayton's writings throughout this time will see in this volume the careful elaboration and critical analysis of many of the views which he first announced a good many years ago. "World Weather" is far more a discussion of certain selected topics in meteorology than it is a general text-book of that science. In fact, it is not a text-book at all, in the ordinary meaning of that term. It is true that there is a consideration of certain general matters such as

moisture, clouds and rainfall, for example, and of sky colors and the "visible signs of the sky and air," with brief mention of other well-known meteorological phenomena. In the main, however, the plan of the book is quite different from that with which teachers and students of meteorology are familiar.

The fundamental idea, as the title indicates, is world meteorology, and it is the larger aspects of the subject which are stressed. The usual discussions of the composition of the atmosphere; of the ordinary instruments; of isothermal charts; of the characteristics of the surface winds; of the distribution of the mean annual rainfall, etc., are lacking. As we see it, "World Weather" is suited for the use of the teacher and the advanced student of meteorology; of the physicist and astronomer with an interest which reaches somewhat beyond the narrower limits of their own sciences; of the intelligent reader who, knowing something of meteorology, wishes to enlarge his vision by acquaintance with some of the new researches in the mechanism of the atmosphere which promise so much for the future. While much of the book can be read easily and rapidly, there are many parts of it which, in order to be fully understood, need careful study.

The real purpose is to bring out the relations between the variations of solar radiation and terrestrial meteorological conditions as Mr. Clayton sees them, not only in connection with forecasting for a week ahead, which he himself carried on successfully in Argentina, but also in connection with various more or less well established periodicities in weather and solar phenomena. In the introduction the author distinctly states his conviction that the "newer researches . . . indicate that the time is near at hand when weather changes can be anticipated so far in advance as to save much of the loss and distress which now follows in the wake of the unexpected adverse conditions." Mr. Clayton believes that without solar changes "there would result a balanced system of atmospheric changes such that the same conditions would return year after year at the same time of day and at the same time of year." He believes that the irregular changes which we call weather result chiefly, if not entirely, from irregular changes in solar radiation. Not only so. Our author also attributes long-period changes of temperature and of rainfall, occupying several decades or even centuries, at least in part to solar changes. Even glacial epochs may have been due to great increases in solar radiation, which would have intensified tropical rainfall, the oceanic cyclones and the continental anticyclones of high latitudes, thus bringing about lower temperatures over the high latitude land areas.

A detailed explanation is given of the method of forecasting in Argentina on the basis of the observations of solar radiation made by the Astro-Physical Observatory of the Smithsonian Institution in Chile. This method, begun December 12, 1918, originated with Mr. Clayton, and was made possible through the cooperation of the Smithsonian Institution. The field is one which our author has made peculiarly his own, and to it he has devoted a large part of his time during the past few years. It is one of the outstanding developments in the history of weather forecasting. The changes in temperature and in pressure from day to day are believed to have close relation to short-period changes in solar radiation. The monthly means of temperature and pressure are also closely related to the monthly means of solar radiation. Further, year-to-year variations are shown to be connected with year-to-year variations in rainfall and in the height of rivers in North and South America and in Australia. Long-period weather changes are found which correspond with the sunspot period, but these are less marked than the changes of shorter duration. Pressure, rainfall, temperature and other phenomena were investigated at stations all over the world, and oscillations similar to those of the sunspots appear, although the weather conditions are more variable than the sunspots. Sunspot influence shows both an annual and a semi-annual period, but the conditions are far from simple. There is some evidence that snowfall is deeper and icebergs are more numerous at sunspot maximum, and that the Nile and other tropical rivers are highest at sunspot maximum, while rivers like the Parana in temperate regions show an inverse effect.

There are other subjects to which Mr. Clayton makes noteworthy contributions. In regard to the general circulation of the atmosphere our author, after a consideration of the various views which have been advanced during the past fifty years or more, states that Ferrel's theory furnishes the simplest and most plausible explanation yet given of the motions of the atmosphere under the influence of heat and gravity on a rotating body like the earth. This is a very interesting confirmation of the soundness of Ferrel's reasoning, for at the time of his writing very few observations of cloud movements had been made. This view may, however, possibly need modification as further facts become known. The explanation of the essential facts of upper air temperatures in relation to the stratosphere and its height above sea-level is found in the expansion and cooling of the ascending air in equatorial latitudes and in its warming by compression and cooling by radiation as it descends toward the poles on the upper gradients. Regarding the much-discussed question as to the origin of extra-tropical cyclones and anticyclones, Mr. Clayton believes that an explanation is found in contrasts of temperature observed when large bodies of colder air

lie in close proximity to warmer air. The available facts as to temperature, winds and pressures in cyclones and anticyclones are found to be in agreement with the results of computation, so that the statement can be made, "sharp contrasts in temperture in adjacent bodies of air causing steep gradients are fully capable of producing the permanent and wandering cyclones and anticyclones of the atmosphere in temperate regions." Mr. Clayton's views on this matter are different from the recently much-discussed Bjerknes polar front theory, yet there are points of resemblance between the two. Regarding tropical cyclones there is naturally a good deal of doubt, although here also differences of temperature between a central area and the surrounding air are believed to explain the origin.

Other subjects discussed in "World Weather" there is no opportunity to consider here. There are chapters on the physics of the air in relation to solar and terrestrial phenomena; and on the meteorology of the sun, and there are three appendices dealing with mathematical methods of treatment. We regret that, in a book of this character, many of the illustrations are very crude, and a few are so indistinct that they are barely serviceable. Many references are incomplete according to the usual standards in such matters, and occasional references to writers in the text without any indication as to what and where these persons have written are not helpful in a scientific discussion. Misprints are fairly numerous, but in no case are these so glaring that the meaning is obscured. The summaries at the beginning of each chapter are a very useful feature of the book. When so much that is new and necessarily still more or less controversial is presented by an author of Mr. Clayton's standing there is sure to be a more or less animated debate as to the value of the evidence and as to the methods of using it. Into any such critical analysis it is impossible to enter here, nor has the reviewer any desire to do so. It may very likely be that the author himself may see reason to revise and to modify some of his conclusions, and it is almost certain that a good many persons, meteorologists and others, will hesitate to accept them all as they stand. They are by no means all equally convincing. But that the author has taken infinite pains in his laborious and time-consuming investigations is evident on every page, and that he has written a very important chapter in the new world meteorology no one can deny. It is a very inspiring view of the future of meteorology in relation to long-range forecasts, of immense economic importance to man, which Mr. Clayton here gives us.

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SPECIAL ARTICLES

INHERITANCE OF DIRECTION OF COILING IN LIMNAEA

A RECENT paper by Boycott and Diver (1923, Proc. Roy. Soc., 95 B; 207) on the inheritance of dextral and sinistral coiling in the snail Limnaea suggests that this character may give an exceptionally clear illustration of "maternal" inheritance that is nevertheless dependent upon the chromosomes.

These authors find that if a single individual of Limnaea is isolated at an early stage it will reproduce, presumably by self-fertilization. Broods produced in this way are always either wholly dextral or wholly sinistral (with the rare exceptions noted below)—but either type of parent may produce either type of brood. This result agrees with the findings of Mayor (1902) and Crampton (1916) on the viviparous Tahitian land-snail Partula, where a given individual contains in its brood-pouch only one type of young. A sinistral individual may have either sinistral or dextral young—but never both types at once; and the same is true for a dextral mother.

Boycott and Diver have also mated together two individuals, and have reared from such pairs mixed broods, which they report as giving 3 dextral : 1 sinistral or 1 dextral : 1 sinistral. In the absence of numerical data, and in view of the fact that the eggs from the two parents were not separated in these experiments, one may doubt if these ratios are anything more than fortuitous ones due to the two members of the pairs in question producing different types of offspring. If one does interpret these ratios as merely chance ones, it becomes possible to formulate a much simpler interpretation than the one suggested by these authors.

An analysis of the data presented suggests that the case is a simple Mendelian one, with the dextral character dominant, but with the nature of a given individual determined, not by its own constitution but by that of the unreduced egg from which it arose.

This last assumption becomes extremely plausible when it is recalled that it was shown by Crampton and by Kofoid in 1894 that dextral and sinistral snails can be distinguished at least as early as the second cleavage division (perhaps at the first), since the cleavage-pattern of one is the mirror-image of that of the other. A character that appears so early in development might well be expected to be determined by the genes present in the mother—*i.e.*, in the unreduced egg, rather than by the combination present after reduction and fertilization. Yet the results obtained by Boycott and Diver can not be accounted for unless it is supposed that the sperm does actually

produce an effect, though the effect is delayed for one generation.

The hypothesis here suggested may be made clearer by the following elaboration. Let the recessive gene for the sinistral character be represented by *l*, and its dominant allelomorph for the dextral character by *L*. Then any heterozygote, Ll, will produce by self-fertilization three types of offspring—LL, Ll and ll. Since all the eggs contained the gene L before reduction, all these individuals will be dextral in somatic appearance; but the ll individuals will themselves produce only sinistral offspring. If an ll individual of this family mates, as a female, to an LL, the offspring will all be sinistral (since the mother carried no L); but they will be Ll in constitution and will therefore produce only dextral offspring. Further combinations may easily be worked out.

It is probable that dextral snails can not mate with sinistral ones; this being the case one might expect that heterozygous individuals would quickly disappear from the colonies, in which case no such results as recorded would be obtainable. The paper under discussion gives a clue as to why the heterozygotes do not disappear. In families that were expected to be purely sinistral a dextral individual occasionally appeared. If such individuals are due to some environmental cause and are genetically sinistral, they will of necessity mate with dextrals and produce new families of heterozygotes. This interpretation is borne out by Lang's results with Helix, where the occasional cases of reversed symmetry were found not to be inherited at all.

Further data on the case of Limnaea will be awaited with interest, for it seems likely that we shall have here a model case of the Mendelian inheritance of an extremely "fundamental" character, and a character that is impressed on the egg by the mother.

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VOICE AS A FACTOR IN THE MATING OF BATRACHIANS[1]

CHORUSES of frogs and toads form one of the impressive sounds of nature. Nevertheless, little or no significance has been attributed to voice in the mating of batrachians. It is stated not to control the direction of migration towards the breeding grounds, or the movements of individuals on the grounds (Boulenger,[2] Cummins[3]). It is generally believed that "courtship does not take place in any of the tailless batrachians. The female is seized by the first comer, . . . "[4] Some years ago it was pointed out by Courtis[5] and later by Miller[6] that the toad responds to sound readily during the breeding season, and that the female may even be attracted towards the calling male. But Cummins[7] has recently shown that in the case of frog material the "*voice does not direct* the movement of the frogs into the pond" and "that sex 'recognition' . . . results from the differential behavior of the two sexes when clasped, . . . "

During the past season I have studied the problem with tree frog material. Such material is especially favorable because their breeding grounds are generally less crowded than in the case of the other species, and direct observation of individuals is possible. This method of direct observation was unfortunately not employed by Cummins.

The species most thoroughly studied by me was the little-known *Hyla andersonii*. At Lakehurst, N. J., the males begin calling in early May. They call from the ground and generally from concealment. Later in the month they call from the tops of bushes or from trees several feet from the ground. The breeding does not occur simultaneously throughout the region, or even in the same bog. Individual males that were kept under observation by means of flash lamps throughout the night were seen to leave their high calling stations and make their way to nearby sphagnum-choked ditches or to slow-flowing streams in the bog. Each took up an isolated position near one of these basins and began to call again. Females were first discovered making their way across the bog. In three instances their movements were closely followed. They proceeded directly across the marsh, over ditches and puddles toward particular males. In all three cases the calling males paid no attention to the approaching females. In one case the female leaped directly upon the back of the male. He threw her off and continued calling. She leaped on his back again, but again he threw her off. This time, however, he turned and before she could spring again had embraced her. In the second case the female leaped at the calling male but receiving no attention, she circled twice around him, nudging him with her limbs as she endeavored to draw as near to him as possible. In the third case the calling male paid no attention to the female and amplexus did not occur. In the former cases oviposition took place in the adjacent water. Oviposition in *H. andersonii* differs from that of other American species of Hyla, in that the eggs strike the body of the male and are thrown to the bottom of the ditch, where they may or may not adhere to the sphagnum or other vegetation.

[1] Summary of a paper read before the Linnaean Society of New York, November 14, 1922.

[2] Boulenger, G. A., 1912, *Proc. Zool. Soc. London*, p. 22.

[3] Cummins, Harold, 1920, *Jour. Exp. Zool.*, XXX, pp. 325–343.

[4] Boulenger, G. A., 1897, "The Tailless Batrachians of Europe," p. 68.

[5] Courtis, S. A., 1907, *Amer. Nat.*, XLI, p. 678.

[6] Miller, Newton, 1909, *Amer. Nat.*, XLIII, p. 650.

[7] *Loc. cit.*, p. 342, italics his.

Later in the season I made a single observation on the Gray Tree Frog, *H. versicolor*, which would tend to prove that in that species, too, the female is attracted by the call of the male. In this instance a female was seen to approach a calling male from behind. The approach was very rapid and the female leaped without hesitation on his back. The male broke off his call at once, turned and embraced the female.

When the movements of individuals of other species have been studied during the breeding season, I believe it will be shown that voice plays a considerable part in bringing the two sexes together. The problem of sex retention is another one, and need not be considered here. Many, perhaps most batrachians in the tropics, breed in isolated pairs. If there were no mechanism for bringing the two sexes together, these frogs and toads would have little chance of breeding.

G. K. NOBLE

THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY

THE MILWAUKEE MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE sixty-sixth general meeting of the American Chemical Society was held in the auditorium, Milwaukee, Wisconsin, Monday, September 10, to Friday, September 14, 1923.

Opening addresses were given by Clare H. Hall, chairman of the Milwaukee Section of the American Chemical Society; Honorable Daniel W. Hoan, mayor of Milwaukee; Honorable Emmanuel Philipp, president Milwaukee Association of Commerce, and Rev. Albert C. Fox, President Marquette University. Dr. E. C. Franklin responded on behalf of the Society.

Two general addresses were the feature of the Tuesday morning session as follows:

Charles F. Burgess, director of the Burgess Laboratories. "Marketing Chemical Discoveries."

Arthur I. Kendall, dean of the Medical School, Northwestern University. "Bacteria and the Chemist."

The previous custom of having general addresses in the afternoon session was abandoned and instead thereof three special meetings of the more fundamental divisions of Physical and Inorganic Chemistry, Organic Chemistry and Chemical Education were held with papers especially selected to meet the needs of all chemists present.

On Tuesday evening a complimentary dinner and entertainment was given to the members and guests by the Milwaukee Section. Approximately one thousand sat down to this dinner. The program consisted of songs, dancing and instrumental music.

On Wednesday at 8 p. m., a reception was held at the Marquette University gymnasium followed by public addresses by Mrs. Thomas G. Winter, president General Federation of Women's Clubs, and the annual address of the president of the society. President Franklin took as his subject, "Systems of Acids, Bases and Salts." Past President Edgar F. Smith presented the Priestley Medal *in absentia* to Professor Ira Remsen.

On Thursday evening group dinners and college reunions were held and the members also attended a very interesting and lively amateur boxing contest at the Milwaukee Athletic Club.

A special program consisting of dinners, automobile drives, etc., was arranged for the ladies and a complimentary dinner was given to the wives of the councilors on Monday evening.

Wednesday and Thursday were otherwise given up wholly to divisional meetings.

The following Divisions and Sections met: Divisions of Agricultural and Food Chemistry, Biological Chemistry, Cellulose Chemistry, Dye Chemistry, Fertilizer Chemistry, Industrial and Engineering Chemistry, Leather Chemistry, Chemistry of Medicinal Products, Organic Chemistry, Petroleum Chemistry, Physical and Inorganic Chemistry, Rubber Chemistry, Sugar Chemistry, Water, Sewage and Sanitation; Sections of Chemical Education, Gas and Fuel Chemistry, and History of Chemistry.

The divisions elected officers as follows:

DIVISION OF AGRICULTURAL AND FOOD CHEMISTRY: *Chairman,* C. H. Bailey; *Vice-chairman,* E. F. Kohman; *Secretary,* C. S. Brinton; *Executive Committee,* G. E. Holm, J. W. Read, R. H. Carr.

DIVISION OF BIOLOGICAL CHEMISTRY: *Chairman,* W. T. Bovie; *Secretary,* R. A. Dutcher.

DIVISION OF CELLULOSE CHEMISTRY: *Chairman,* G. J. Esselen, Jr.; *Vice-chairman,* Louis E. Wise; *Secretary-Treasurer,* L. F. Hawley; *Executive Committee,* The Officers ex-officio and Harold Hibbert, A. W. Scharger.

DIVISION OF DYE CHEMISTRY: *Chairman,* W. J. Hale; *Vice-chairman,* R. E. Rose; *Secretary,* R. Norris Shreve; *Executive Committee,* L. A. Olney, L. F. Johnson.

DIVISION OF FERTILIZER CHEMISTRY: *Chairman,* F. B. Carpenter; *Vice-chairman,* R. N. Brackett; *Secretary,* H. C. Moore; *Executive Committee,* H. J. Wheeler, C. H. Jones, E. W. Magruder and A. J. Patten.

DIVISION OF INDUSTRIAL AND ENGINEERING CHEMISTRY: *Chairman,* D. R. Sperry; *Vice-chairman,* W. A. Peters; *Secretary,* E. M. Billings; *Executive Committee,* W. K. Lewis, C. E. Davis, E. R. Weidlein, C. S. Miner, C. E. Coates.

DIVISION OF LEATHER AND GELATIN CHEMISTRY: *Chairman,* John Arthur Wilson; *Vice-chairman,* F. P. Veitch; *Secretary,* Arthur W. Thomas; *Executive Committee,* I. D. Clarke, L. M. Tolman.